

BRIEF COMMUNICATION

RECORDS OF MOSQUITOES (DIPTERA: CULICIDAE) FROM THE COOPER BASIN IN NORTH-EASTERN SOUTH AUSTRALIA

The mosquitoes (Diptera: Culicidae) of arid and central Australia are not well documented. Although Lee and Woodhill¹, O'Gower² and Marks³ have provided limited distribution records for some species, most data for mosquitoes in this region stem from the investigations of Kay⁴ and Kay *et al.*⁵ in Charleville, south-western Queensland. Given the abundance of industry and agriculture in the region and the presence of mosquito-borne viral illness^{6,7} a greater understanding of the vectors in this region is required. There is also a suggestion that mosquito-borne encephalitis viruses periodically invade south-eastern Australia from more northerly foci⁸. No published information exists for mosquitoes in north-eastern South Australia (SA).

From December 1998 to December 1999, we conducted a study of mosquitoes at four sites in north-eastern SA, in the locality of the Moomba and Tirrawarra oil and gas fields. A history of seasonally high mosquito numbers in this area⁹ and heavy rainfall in September 1998 were catalysts for this study, the aim of which was to determine the species of mosquitoes in the area.

The sites were located within the Cooper landscape region of Barlow¹⁰, commonly referred to as 'channel country' which featured grasslands, shrublands, alluvial plains and dunes and watercourses, in a subtropical-dry climate (Type III of Walter & Lieth¹¹).

Mosquitoes were sampled at Moomba camp (28°06' S, 140°11' E), at Gidgealpa waterhole, an ephemeral freshwater body in open *Eucalyptus* and *Acacia* woodland 30 km to the north (27°47' S, 140°10' E) and at two sites on a floodplain near Embarka swamp, approximately 50 km north of Moomba camp and 50 km south of the Coongie Lakes system. The swamp, on the Cooper Creek, is in the middle of a floodplain supporting lignum shrubland (*Macchiaea floricola* Meissner), hardy (*Marsilea drummondii* A. Braun.), and sparse *Acacia* woodland. Embarka swamp Site 1 was at the northern end of the shrubland/floodplain, approximately seven km north of the Tirrawarra oil and gas camp (27°37' S, 140°09' E), Embarka swamp Site 2 was approximately one km north of the camp.

Mosquitoes were sampled using dry-ice baited miniature light traps¹². These traps predominantly capture host-seeking adult female mosquitoes. A single trap was set at least one hour before sunset and retrieved at least one hour after sunrise at each site on three (sometimes four) occasions from December 1998 to April 1999. Two further traps were set at Gidgealpa waterhole and Embarka swamp Site 1 on 11/11/99. Four traps were set at Moomba camp on 27/12/99 in response to heavy rainfalls there during December (92.8 mm from 16/12/99 to 27/12/99). Mosquitoes were identified using the keys of Lee *et al.*¹³ and Russell¹⁴.

Eleven species were captured in dry-ice baited traps (Table 1). From December 1998 to April 1999, Gidgealpa waterhole and Moomba camp were characterised by very low catch numbers. In contrast, large numbers were captured at Embarka swamp with *Culex annulirostris* Skuse most abundant. *Anopheles annulipes* s.l. Walker and *Anopheles univittatus* Edwards were captured in large numbers periodically at the Embarka swamp sites. The two traps set on 11/11/99 yielded only a single, male *Aedes* (*Macleaya*) Marks species 126 at Gidgealpa waterhole. No mosquitoes were caught at Embarka swamp Site 1 on this date.

Traps set at Moomba camp on 27/12/99 captured large numbers of *Aedes edwardsi* Mackerras, with smaller numbers of *Aedes sapiens* Marks, *Aedes* (*Ochlerotatus*) Marks species 85 and *Cx. annulirostris*. Rainfall at Moomba in mid-December 1999 was probably responsible for the large numbers of *Aedes* mosquitoes, which have desiccation-resistant eggs that hatch upon inundation. This trait makes some *Aedes* species well adapted to environments where rainfall is episodic.

Mosquitoes biting humans were captured from bare legs from the knees down and on feet using a mouth operated aspirator and stored in polystyrene drinking cups covered with nylon netting. All mosquitoes were caught by the authors (75 kg and 90 kg respectively) sitting opposite each other, using a single aspirator, combining the catch from both pairs of legs. This method was used despite the risk of mosquitoes in the area carrying arboviruses, of which both authors were aware. During the day, this was done whenever biting mosquitoes were evident. Nocturnal collections were made on three occasions for ten minutes every hour from sunset until sunrise at Embarka swamp Site 2 and Moomba camp (Table 2). Several other biting catches commenced at sunset and continued for two to three hours.

Mosquitoes were caught from humans at Embarka swamp Site 2 on 9/12/98, 12/1/99, 26/1/99, 16/2/99, 18/3/99 & 11/11/99. *Culex annulirostris* was the predominant biting species at this site. All night biting collections of this species (Table 2) peaked five to six hours after sunset (i.e. 0130 to 0230 h). Of those species not sufficiently abundant to present all night catch data, *Ae. edwardsi* was caught biting during the day and throughout the night, whereas *An. univittatus* and *An. annulipes* were only caught during the night. *Aedes bancroftianus* Edwards was caught biting at sunset at this site.

At Moomba camp, *Cx. annulirostris* and *An. annulipes* were caught at sunset on 8/12/98. On 27/12/99, *Ae. edwardsi* was caught biting humans throughout daylight hours and was the predominant biting species when an all night catch was performed (Table 2). *Culex annulirostris*, *Aedes sapiens* Marks, *Aedes theobaldi* (Taylor) and *An. annulipes* were caught in smaller numbers throughout the night at this site.

⁹ T. Higgins Santos Ltd, Adelaide, pers. comm. (1999).

TABLE 1. Mosquitoes captured by dry-ice baited miniature light traps from December 1998 to April 1999 and December 1999.

Species	December 1998-April 1999 ^a				Dec. 1999 ^b
	Moomba Camp causeway	Gidgealpa waterhole	Embarka Swamp Site 1	Embarka Swamp Site 2	Moomba Camp
<i>Aedes alternans</i> (Westwood)	0	1	0	0	6
<i>Ae. eidsvoldensis</i> Mackerras	0	1	6	18	1215
<i>Ae. sapiens</i> Marks	0	0	0	0	102
<i>Ae. theobaldi</i> (Taylor)	0	0	0	0	8
<i>Ae. (Och.)</i> Marks sp. 85	0	0	0	0	40
<i>Ae. (Mac.)</i> Marks sp. 126	0	1	0	0	0
<i>Anopheles annulipes</i> s.l. Walker	0	2	104	289	23
<i>An. amictus</i> Edwards	0	0	24	238	0
<i>Culex annulirostris</i> Skuse	6	1	314	1789	37
<i>Cx. australicus</i> Dobrotworsky & Drummond	1	0	20	5	0
<i>Cx. quinquefasciatus</i> Say	24	0	0	0	0
total	31	6	468	2339	1431
no. sampling nights	3	3	4	3	1 ^b

^a 1998/99 sampling dates: Moomba causeway - 8/12, 12/1, 18/3; Gidgealpa waterhole - 9/12, 12/1, 18/3; Embarka swamp Site 1 - 8/12, 12/1, 18/3, 1/4; Embarka swamp Site 2 - 8/12, 26/1, 18/3
^b Moomba camp was sampled using four traps on 27/12/99.

TABLE 2. *Culex annulirostris* and *Aedes eidsvoldensis* mosquitoes biting humans for a 10 minute period each hour from sunset (SS) to sunrise (SR) at Embarka swamp Site 2 and Moomba camp.

Time of sampling	Embarka swamp Site 2		Moomba camp
	26/1/99 ^a <i>Culex annulirostris</i>	16/2/99 ^b	27/12/99 ^c <i>Aedes eidsvoldensis</i>
SS - 1	0	0	3
SS	19	4	22
SS + 1	19	20	9
SS + 2	22	32	4
SS + 3	8	34	7
SS + 4	32	41	2
SS + 5	33	58	3
SS + 6	38	63	0
SS + 7	16	41	1
SS + 8	18	50	8
SR	15	27	3
total	220	370	62

^a SS: 2100h, SR: 0600h; ^b SS: 2040h, SR: 0540h; ^c SS: 2030h, SR: 0530h

All water bodies encountered during this study were examined for the presence of mosquito larvae using a standard dipping technique. Any larvae collected were identified in the laboratory using the key proposed by Russell¹⁰.

Larval collections returned large numbers of *Cy. annulirostris* and *Culex australensis* Dobroworsky & Drummond at locations less than 200 m from Embaraka swamp Site 2 on 26/1/99, 16/2/99, 18/3/99 and 1/4/99. These locations featured an abundance of shallow (less than 0.5m deep), clear, fresh water. Most larvae were collected from the fringes of waterways, particularly where the bank had been disturbed by livestock, leaving isolated water-filled hoofprints. These often contained thousands of larvae of both *Culex* species. Despite this, adult *Cy. australensis* were only collected in small numbers in baited light traps (Table 1). This species is apparently more attracted to unbaited light traps¹¹.

On 27/12/99, numerous ephemeral ground pools within a 1 km radius of Moomba camp were found to contain *Cy. annulirostris* and *An. annulipes* larvae. These waters were created by rainfall during the preceding ten days.

This study has added four species to the list of mosquitoes recorded from SA¹². *Ae. sapientis* and *Aedes (Ochlerotatus)* Marks species 85 have been recorded from several sites throughout the arid zone in north west NSW.

South-west and central Qld¹³ and from Alice Springs NT¹⁴. *Aedes (MacLeaya)* Marks species 126 has been found 520 km to the east at Cunnamulla, Qld, 750 km to the north-west at Alice Springs, NT¹⁵ and near Balgo, WA¹⁶. This is also the first record of *An. amicus* from SA, previously recorded from Charlotte Waters NT (550 km west-north-west), Cunnamulla Qld¹⁷ and Charleville Qld¹⁸, indicating a wide range throughout arid Australia. Previously, *Ae. edwardsi* has only been recorded in SA from Innamincka, 60 km east-south east of Tintawarra camp¹⁹. Twelve mosquito species have thus far been identified from this part of SA.

This study has extended our knowledge of mosquito incidence in the Cooper Basin of SA. High numbers of *Cy. annulirostris*, a vector of Ross River virus, Murray Valley encephalitis and Japanese encephalitis²⁰, are of particular interest. Together with an abundance of feral pigs and native birds (reservoirs for mosquito-borne encephalitis), high biting rates by *Cy. annulirostris* may render the north-east of SA vulnerable to mosquito-borne viral disease.

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P. Whelan: Territory Health Services, Darwin NT, pers. comm. (1999).

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